B.E (EXTC) VIII Rev 8/05/13

Advanced Microwave Engg.

P3-upq-Feb.-13KL-12 A4 E

Con. 7485–13. **(REVISED COURSE)** **GS–3013**

(3 Hours) **[Total Marks : 100**

N.B. :(1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions from remaining **six** questions.
(3) Use Smith chart if **necessary**.
(4) **Figures** to the **right** indicate **full** marks.

1. (a) Explain Large signal characterization with reference to load pull countors, how it is measured ? **5**
   (b) What are the causes of low frequency noise and high frequency noise ossociated with the mixer ? **5**
   (c) Define and explain with neat diagram noise correlation matrix for general noisy two port network. **5**
   (d) What is an unilateral figure of merit of an amplifier ? **5**

2. (a) If the transistor has following S-parameters at 5GHz with 50 Ω impedance. **10**

$S_{11} = 0{\cdot}6 \angle -175°$; $S_{12} = 0{\cdot}02 \angle 20°$

$S_{21} = 2{\cdot}2 \angle 35°$; $S_{22} = 0{\cdot}6 \angle -95°$

Determine the stability criteria and plot the stability circles.

   (b) Derive following parameters of an amplifier— **10**
   (i) power gain (G)
   (ii) Available gain (GA)
   (iii) Transducer gain (GT).

3. (a) Explain using suitable diagrams two methods of designing broad band amplifier. **10**
   (b) A BJT with $I_c = 30$ mA and $V_{CE} = 10$ V is operated at a frequency of 1·0 GHZ in a 50 Ω system. Its S–parameters are— **10**

$S_{11} = 0{\cdot}73 \angle 175°$; $S_{22} = 0{\cdot}21 \angle -80°$

$S_{12} = 0{\cdot}0$; $S_{21} = 4{\cdot}45 \angle 65°$

Determine whether the transistor is unconditionally stable. If yes, calculate the optimum terminations, $G_{S,max}$, $G_{L,max}$, $G_{TU,max}$.

4. (a) A certain GaAs MESFET has following noise figure parameters measured at **15**

$V_{ds} = 50$, $I_{ds} = 20$ mA with 50 Ω resist once for frequency of 9 GHz,

$F_{min} = 4$dB, $\Gamma_{opt} = 0{\cdot}55 \angle 175°$, $R_0 = 4\ \Omega$

Plot noise figure circles for given values of f_1 at 2, 2·5, 3·5, 4·5 dB.

   (b) Define stability. List the various criteria for stability. **5**

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5. (a) If a one port microwave diode has $\Gamma_{in} = 1{\cdot}5 \angle 60°$ with respect to $Z_0 = 50\ \Omega$. Design an oscillator for desired frequency of 10 GHZ. **12**

   (b) For two port oscillator at steady-state oscillation prove that if :— **8**

$$\Gamma_L \ \Gamma_{in} = 1 \quad \text{then} \ \Gamma_{in} \ \Gamma_{out} = 1$$

6. A certain MESFET is baised for large signal class A operation with the following small signal S-parameters at 5 GHZ :— **20**

$$S_{11} = 0{\cdot}55 \angle -150° \ ; \ S_{12} = 0{\cdot}04 \angle 20° \ S_{21} = 3{\cdot}5 \angle 170° \ S_{22} = 0{\cdot}45 \angle -30° \ ;$$

The large signal forward transmission coefficient S_{21} is measured to be $S_{21} = 2{\cdot}8 \angle 180°$. Design a Large – Signal Class A amplifier with maximum transducer gain in a 50 Ω system. Assume ± 0·5dB error in gain. What is the high-power amplifier gain ?

7. (a) Write a note on optimal loading used in 1 + PA design. **10**

   (b) A wideband amplifier (2 – 4 GHZ) has gain of 10dB, an O/P power of 10 dBm and a noise figure of 4 dB at room temperature. Find the output noise power in dBm. **10**

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